DOCUMENT RESUME

ED 209 165 SO 013 725

AUTHOR Diem, Richard A.
TITLE Computers in the Social Studies Classroom. How to Do It Series, Series 2, No. 14.
INSTITUTION National Council for the Social Studies, Washington, D.C.
PUB DATE 81
NOTE 8p.
AVAILABLE FROM National Council for the Social Studies, 3615 Wisconsin Avenue, N.W., Washington, DC 20016 ($1.50, quantity discounts available).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Computer Assisted Instruction; Computer Assisted Testing; Computer Managed Instruction; *Computer Oriented Programs; *Computers; Definitions; Educational Trends; Elementary Secondary Education; National Surveys; Resource Materials; *Social Studies; Teacher Education

ABSTRACT

Designed to introduce social studies teachers to computers and to suggest ideas for their potential applications in social studies classrooms, this booklet is arranged in various sections. One section describes the origins of the modern computer, another defines computer terminology, and two sections explain computer hardware and computer software. Another section discusses three major ways in which computers are being used in schools. The first is computer assisted educational management systems which are designed to provide the evaluation of entering students, prescription formulating, individualization of instruction, record keeping, curriculum development, and evaluation. Second, computer assisted instruction (CAI) is being widely used. Drill and practice, tutorial help, simulations, inquiry modes (these allow students to ask questions within the context of the lesson), problem solving, and computerized games are common varieties of CAI. And third, computers are being used in what is called computer assisted learning. Students use the computer as an aid in solving problems, reviewing, and evaluating their progress. The booklet discusses training teachers to use a computer. Instructional software for teachers is cited. A sample lesson, "Election Projections," for using computers in the social studies classroom is provided. The booklet ends with a discussion of what the future holds. The results of a national survey to assess the use of computers in public elementary and secondary schools are also provided. A bibliography is included. (Author/RM)

How to Do It Series, Series 2, No. 14.



# Computers in the Social Studies Classroom

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## Introduction

In March, 1980, Jack Chambers and Alfred Bork sampled 974 school districts across the United States to assess the use of computers in public elementary and secondary schools. The 62.3% of the districts that returned the questionnaires indicated that:

1. 90% used computers for either instructional or administrative purposes. This number was expected to rise to 95% by 1985.
2. 74% of the districts included the use of computers among their instructional strategies. It is anticipated that this will increase to 87% by 1985.
3. 54% currently use computer-assisted instruction (CAI) in one form or another. CAI encompasses learner-computer interaction.
4. Most computer-assisted learning is heavily concentrated at the secondary level. Mathematics, natural sciences, and business and language arts use computers most often.
5. Computer-assisted learning is expected to expand to other high school fields, including the social studies, while extensive use at the elementary level is also foreseen.
6. Major obstacles to wider use of the computer as a learning tool appear to be: limited financial resources, lack of knowledge about computers on the part of administrators and faculty, unfavorable attitudes about technology, and inadequate computer-learning packages.

Financial limitations, while they cannot be overlooked, will not continue to prevent schools from entering the computer age. The $3,000 micro-computer system of today is comparable to the $200,000 computer system of twenty years ago (Moursund, 1980). Debate over purchasing computer systems for instructional use is all but over. Most public school districts are now more concerned with training their personnel to use newly purchased or soon-to-be-acquired systems than they are about monetary constraints.

The ignorance of many teachers about computers, and about educational technology in general, is appalling. Few pre-service teacher-education programs include computer training in their curricula. Content specialists outside of mathematics and the sciences may not even be exposed to basic instruction about computers, let alone programming skills.

This How-To-Do-It booklet is designed to introduce social studies teachers to computers and their potential applications in social studies classrooms. The impressive advances in computer technology make it imperative that computer education be a continual process. This How-To-Do-It booklet should be viewed as a starting point, rather than as the final word on computers.

## Origins of the Modern Computer

Simplifying complex tasks and using abstractions to represent reality may have originated when people in caves traded goods and services among themselves. As commerce and interpersonal relationships became more complex, the need for devices to keep track of these interactions became pressing. Probably the first machine to record transactions such as these was an abacus.

Although the Chinese have been given credit for the invention of the abacus, other civilizations developed similar types of counters and recorders. It is important to realize that the modern computer functions in the same manner as the abacus. It manipulates data, stores information, and allows the user to retrieve knowledge as needed, and—as with the abacus—the computer does only what it is told to do.

The modern computer age began in the mid 1930s when a group of English scientists, led by Alan Turing, began to develop a general-purpose computer. Spawned by technological advances made during World War II, the Mark I, called the first Electronic Brain, appeared in 1944. Two years later, ENIAC, the first electronic computer, was unveiled. A major technological breakthrough occurred in 1947 with the invention at Bell Laboratories of the transistor. This allowed computer manufacturers to replace existing vacuum tubes, which burned out very quickly, with transistors. By 1951, the UNIVAC computer was marketed for commercial use.

The innovation that made computer technology affordable to the mass market was the integrated circuit, which made its appearance in 1965. Now complex circuits could be imprinted on a single small silicon chip. As the use of these chips increased, their costs decreased. Miniaturization became more and more part of the computer industry, and with it came development of the minicomputer. Even smaller than the minicomputer, the microprocesser, a single IC computer with a built-in computer processor for limited applications (Poirot, 1980), was introduced and adapted for use in many products, such as ovens and cars.

As this is being written, other types of computer applications with video-disks and interactive television are being improved. We have just crossed the threshold leading to ways in which computers will be used.

## Computer Terminology

As with other disciplines, computer science has its own vocabulary. Listed below are some of the more widely used computer terms. Understanding their use is a first step toward computer awareness.

*Algorithm:* a set of rules, in a definite order, that pertain to the solving of a problem.

*Alphanumeric:* information that consists of both letters and numbers.

*Bits:* units of information that signal to the computer what it is to do. They are single digits in binary math. They can be either 1 or 0.

*Bug:* a program defect in either the computer hardware or software.

*Byte:* a unit of information composed of 8 bits. The computer treats this as a single unit.

*Cathode Ray Tube (CRT):* a unit for displaying information—similar to a TV tube.

*Central Processing Unit (CPU):* the section of the computer that interprets data and executes instructions.

*Chip:* a rectangular or square silicon chip on which integrated circuits are imprinted.

*Debug:* correct a malfunction in a program or operation.

*Disc (Disk):* a magnetic storage device resembling a small 45 RPM record. Sometimes called "Floppy Disk."

*Flow Chart:* the way in which a computer program is diagrammed. It includes instructions as well as data.

*Hardware:* the actual machinery of a computer.

*Loop:* a self-contained series of instructions whose last command directs the computer to repeat the entire cycle.

*Memory:* the amount of data and instructions that a computer can store. The capacity of a computer's memory is usually represented in thousands of bytes by the symbol K (8K, 16K, 32K, for example).

*Micro-computer:* a digital computer whose processing unit is a micro-processor.

*Program:* a set of instructions to the computer that directs it to solve a problem.

*Random-Access Memory (RAM):* a computer-storage device from which a user can read data and into which she or he can write data without sequential processing.

*Read-Only Memory (ROM):* a computer-storage device that cannot be changed in computer operation. The user can only read from this memory.

*Software:* the computer program, and off-line materials used with computer operations.

*Terminal:* hardware device that allows user to interact with computer. Usually consists of a CRT device, keyboard, and an input device such as a disk or cassette recorder.

*Time-Sharing:* system where one or more terminals are tied together and share time allotments from a large central computer.

## Computer Hardware

The hardware in a computer system is the actual machinery used to operate the computer. The major components in most systems are:

*Input Device:* the instrument used to get information and data into the system. Usually this is a keyboard, a cassette recorder, or a disk-drive.

*Output Device:* the apparatus that receives the input and puts it into a useable form for the user. Examples are a printer or a video receiver (Cathode Ray Tube).

*Memory Unit:* place in the computer where words and numbers are stored and later retrieved.

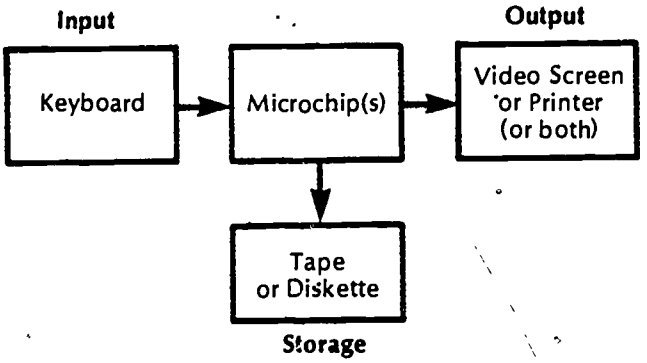
*Central Processing Unit:* section of the system that interprets data and executes instructions.

The major difference among types of computer hardware is their capacity for storing information in the *primary storage unit.* Memory can vary greatly, depending on the size and type of equipment used. For example, a school system that is tied into a large central computing system could have hundreds of thousands of bytes available to students and teachers for various applications. Conversely, the home and personal micro-computers vary from 4 bytes up to 64,000. While all computers do the same things, the larger and more expensive units do them faster, store more data, and have a larger variety of input and output devices.

The computers that are most widely used in public schools are classified as *digital computers.* These machines use data that are in discrete units, such as census figures, historical dates, and names of rivers. The other type of computer, an *analog computer,* deals with continually changing physical phenomena. The changing courses of a river might be one type of analog data. These types of computers are most widely used in space and military projects.

The type of computer hardware that has become most popular and recognizable in recent years is the *microcomputer.* The low cost and portability of this system have been achieved through the development of the *microprocessor,* a small silicon chip (usually narrower than a centimeter) that has imprinted on it integrated circuits which store information.

The micro-computer system is composed of: an input device (most likely a keyboard), one or more micro-chips, a storage device for memory (either a tape or diskette system), and an output device (a video screen, printer, or both). Taken together, the system looks like this:




The great increase in micro-computer purchases is directly related to the continuing low cost of the microprocessor chips. This has enabled the memory components to increase at the same time that costs to the buyer have gone down.

A list of various micro-systems, with a notation on their memory capabilities, follows:

| System | Memory 16K | Memory Expansion 32K/48K |
|---|---|---|
| APF Imagination Machine | ✓ | X |
| Apple 11 Plus | ✓ | ✓ |
| ATARI 800 | ✓ | ✓ |
| ATARI 400 | ✓ | X |
| Ohio Scientific CYP | ✓ | ✓ |
| Commodore PET | ✓ | ✓ |
| Sinclair ZX80 | ✓ | X |
| Texas Instrument TI99/4 | ✓ | X |
| Radio Shack TRS-80 (Model I) | ✓ | ✓ |
| Radio Shack TRS-80 (Model III) | ✓ | ✓ |
| Radio Shack TRS-80 (Color) | ✓ | X |

The cost of each of these (as of the summer of 1981) varies from approximately $400.00 for the Sinclair ZX80 to $1,200 for the ATARI 800 and TRS-80 Models I and III. As one adds on more memory and peripheral equipment, the cost goes up.

## Computer Software

Software comprises the instructions to the computer that tell it what to do. The software is written in a step-by-step instructional sequence called a *program.*

There are two types of software: system software and application software. *System software* organizes the computer's memory. *Application software* is made up of programs that complete specific tasks. Both types of software are written in *computer languages* that the machines understand.

There are a large number of "universal languages," such as BASIC (Beginners All-Purpose, Symbolic Instruction Code), COBOL (Common Business-Oriented Language), FORTRAN (Formula Translation), and PASCAL, that have been written. Programs using these languages can be used on various types of computers and were developed independently of the computer hardware.

Different models of computers, such as the TRS 80, Apple, or the Commodore PET, use different languages and variations of the same language, depending on size and memory units. Various languages can be used with the same computer, providing that one writes a *translation program* for them.

Listed below is an example of part of a Test Writing Program developed by John Warren (1980) of East Carolina University. It is written in BASIC for the TRS-80 computer.

TEST WRITING PROGRAM

```
10 To convert to disk use, remove apostrophe where
   indicated and replace input #—1 and print #1 with
   input #1 and print #1. Where input refers to a string,
   convert to line input #1
20 CLS: CLEAR2000:1=1:J=0
30 Print @4 "COMPUTER ADMINISTERED TESTING
   PROGRAM FOR THE TRS-80"
40 Print "TAPE #1 (DATA TAPE CREATION)"
50 Print "BY PROFESSOR JOHN WARREN, EAST CARO-
   LINA UNIVERSITY"
```

Note that the type and kind of instructions given to the computer vary depending on the task which it will be asked to complete.

Generally, the people who develop software are identified as *computer programmers*. They usually have a broad background in various computer languages. With the advent of micro-computers, however, more and more home programs are being written. In fact, a major cottage industry has sprung up over the past few years; groups of computer users have produced a potpourri of programs ranging from programs for games to programs for teaching basic skills.

One need not be a programmer to use software. There are many "canned programs" available and, depending on the nature of the problem and curriculum to be dealt with, these will probably suffice. However, most people who have an interest in computers soon want to learn how to tailor software to their own use.

## Computer-Assisted Educational Management System, Computer-Assisted Instruction, and Computer-Assisted Learning

As the use of computers as aids to instruction has expanded, so have the ways in which they are used. Most schools employ computers in three broad categories: (1) as management tools; (2) as means of presenting instruction; and (3) as parts of an integrated approach to learning.

**Computer-Assisted Educational Management Systems** (CAEMS)[1] are designed to provide:

1. *Evaluation of entering students:* Students using a CAEMS program can be assessed to determine their proficiency in various areas. Individual school districts can develop criterion-referenced entry standards for either grades or specific programs in that district and then can evaluate students in a quick efficient manner, placing them in the proper program based on their entry skills.
2. *Prescription formulating:* When students' strengths and weaknesses have been diagnosed by teachers through the use of a management system, tentative prescriptions can be made out by which to direct their instruction. This gives teachers a base line from which to judge academic progress.
3. *Individualization of Instruction:* The problem of individualizing instruction to meet learner needs is one that confronts every educator. A computer-assisted educational system offers a range of advantages. First of all, such a system can provide a wide variety of paths which one can follow through the course materials, allowing for different levels of prerequisite skills and different needs for repetition.
4. *Record-Keeping:* Another major advantage of a computer-assisted educational system is its overall management capability. The computer can monitor, score, store, and respond to a far greater number of questions than most instructors could ever be expected to. In addition, the stored information is instantly available for use by both the computer-assisted educational system and instructor-counselors for the purpose of giving advice or making decisions. Instructional prescriptions and curriculum materials can also be constantly modified to increase their efficiency.
5. *Curriculum Development:* Using CAEMS allows ongoing curriculum development. Modification of materials, based on student progress or the lack of it, is always possible. Lessons can be added or deleted as necessary, and modifications of curriculum for students who will follow can be easily made.
6. *Evaluation:* CAEMS also provides a framework for evaluation that presents maximal information concerning both the success of the lessons or units in achieving their stated outcomes and the effectiveness of the means by which they are pursued.

**Computer-Assisted Instruction** (CAI) encompasses the learner-computer interaction. The student is communicating with the computer, relying upon it for instructions, guidance, and feedback. While there are many varieties of instruction, the most common in use during CAI sequences are:

1. *Drill and Practice:* Exercises used to help students to memorize facts or to master skills. Drill and practice use the computer in its simplest mode.
2. *Tutorial Help:* After a student has worked out certain kinds of problems incorrectly, tutorial help from a computer can remediate the student's weaknesses almost immediately.
3. *Simulations:* The computer gives students models with which to experiment. Simulations create a laboratory within the classroom.
4. *Inquiry Modes:* These allow students to ask questions within the context of the lesson.
5. *Problem-Solving:* The computer provides lessons which feature problems involving a variety of solutions.
6. *Computerized Games:* A student can play against the computer, another person, or himself/herself.

Within all types of CAI instruction, the rate of advancement is determined by student progress. Teachers are constantly able to monitor students' interactions with the computer. The major difficulty in implementing innovative CAI has been the dearth of available software. With the exception of large interactive systems such as PLATO, most of the CAI classroom materials are very elementary drill-and-practice routines. This situation should change within the next year, as major publishing companies enter the software field and develop a greater variety of materials.

**Computer-Assisted Learning** (CAL) uses the computer as part of a total instructional package. Students use the computer as an aid in solving problems, reviewing, and evaluating their progress.

[1] This section is taken from an article written by the author: "Curriculum Management Through Computers," in *American Secondary Education*, Vol. 10, No. 3, Fall, 1980, pp. 29–34.

## Training To Use a Computer[2]

It is paradoxical that computer technology has continually advanced and has become economically feasible for most elementary and secondary schools, while teacher-training in its use has not increased. In 1976 only 6.8% of a sample of 175 colleges of education offered a comprehensive program in computer education as part of their teacher-training curriculum (Baker, 1976). While more universities are now offering computer-literacy courses, few pre-service teachers are exposed to instruction about computers.

In a more recent survey, 94.4% of student teachers (out of a sample of 227) felt unqualified to teach computer literacy (Stevens, 1980). Seventy-three percent of the group also felt that "teacher preparation programs should include instructional applications of the computer as part of the preservice curriculum" (Stevens, 1980). The situation for the teacher already in the classroom is equally disheartening. As school districts rush to buy computers, few offer teachers the necessary inservice training to make the technology useful in classrooms.

A systematic inservice program that integrates a scope and sequences of skills with a computer-literacy curriculum seems most appropriate to remedy this situation. In a program of this type, skill development becomes a focus for instruction. A central feature of this type of program is a computer delivery system for a restructured curriculum that facilitates individualized instruction that appeals to both students and teachers, is manageable within a structured classroom setting, and has a salutary effect on student performance.

Implementation of such a staff-development training program could begin in a one-week training effort during the summer. Participating teachers would be instructed in computer basics and would analyze their own classes to identify components suitable for computerization. After they have completed the introductory activities, an intensive follow-up of classroom activities would occur. This effort could be accomplished in a five-stage sequence:

*Stage 1:* Familiarization with available computer hardware, including immediate hands-on experiences with equipment. Teachers might become acquainted with machine memory, storage capabilities, and input mechanisms. This first effort would be of particular importance, since it would help to dispel much of the mystique surrounding computer technology.

*Stage 2:* A review of all available software in particular grade and subject-matter areas. This review should include the testing and evaluation of classroom software by the teachers, as well as the reading and discussing of description of materials.

Production of software, especially for micro-computers, has become a cottage industry in the past few years. As more computers for personal use have been purchased, individual and local school district production of programs has grown tremendously. While local software representatives can demonstrate their materials, directories of different software products should also be examined. Examples of directories that collate materials and review them are:

1. *School Microware*—produced by Dresden Associates, Department TCT, P.O. Box 246, Dresden, ME 04342.
2. *Micro-Computer Software Catalog*—produced by Opportunities for Learning, Dept L2, 8950 Lurline Avenue, Chatsworth, CA 91311.

The types of programs currently available vary. They range from introductory computer literacy programs to those focusing on specific content areas, such as United States History, Political Science, and Economics. "Selected Sources of Instructional Software" tabulates companies that produce these programs, the systems for which they are designed, and the languages in which they are written.

Since most schools are purchasing micro-computers, rather than main-frame computers, an evaluation form

SELECTED SOURCES OF INSTRUCTIONAL SOFTWARE

| Program | Material Covered | Producer | System |
|---|---|---|---|
| Computer Discovery | Computer Literacy | Science Research Associates | ATARI or Apple II |
| Personal Finance | Consumer Economics | Radio Shack | TRS 80 |
| Policy | Political Science | Digital Education Products Group | Written in BASIC |
| POLITECOM | Political Science | Indiana University Purdue University Indianapolis | PLATO |
| Social Studies, Volumes I and II | Social Sciences | Minnesota Educational Computing Consortium | Apple II |
| Oregon | United States History | Minnesota Educational Computing Consortium | MECC Timeshare System |
| People | Historical Personalities | Minnesota Educational Computing Consortium | MECC Timeshare System |

[2]This section is adapted from an article by the author, "Developing Computer Education Skills: An Inservice Training Program," in *Educational Technology*, Vol. 21, No. 2, February, 1981.

designed specifically for micro-software might also be developed. Questions that should be considered for inclusion on this form are: (1) Does the program have a management system? (2) Are there off-line materials available with the program? (3) Is there an evaluation component in the program? and (4) How long will it take students to work through the program?

*Stage 3:* Teachers would review their curricula to note where computerization is feasible. This is a very important task, and specialists in the area of curriculum could be brought in to help classroom teachers in this process. The restructuring of various segments of the curriculum might also occur at this juncture as computerization begins to take hold.

*Stage 4:* Having begun to analyze their courses and curricula for computerization possibilities, teachers would next meet with a programmer. Ideally, this person would be available for conferences with teachers throughout the school year. By hiring one such professional, schools would relieve teachers of the onus of having to learn computer-programming techniques completely. Naturally, teachers could—and probably would—learn computer language operations, but at their own pace and without unnecessary pressure. At this stage, the major purpose of having teachers meet with a programmer would be to familiarize them with the capabilities and limitations of computer technology.

*Stage 5:* Ongoing staff-development during the school year through an observation and critique system with local training staff would be the major follow-up activity. The integration of skills and computerization would be monitored within the context of regular classroom instruction. Critiques and evaluation of these activities would be provided to teachers to help them to modify their teaching strategies.

## Using Computers in the Social Studies Classroom

Within the broad context of social studies programs, computer technology can assist in many areas. For example:

- Developing a sense of social responsibility.
- Strengthening decision-making skills.
- Using information effectively in a democratic society.
- Increasing understanding of the impact of technology, both historically and in the future.

Teaching in these areas through the use of simulation, role playing, or games on computers is not only feasible, but it can be ongoing. An example of a lesson using computers and social studies concepts and skills follows:

### ELECTION PROJECTIONS

During the past presidential election, a twelfth-grade Government class became interested in studying how pollsters develop and use polling techniques to project election outcomes. With the assistance of an APPLE II micro-computer that their school had purchased, not only was the class able to simulate how groups such as Gallup and Harris do their polling, but it was also able to project the outcome of the local election accurately.

First, the students developed a series of questions to ask potential respondents. There were gleaned from items used by newspaper and magazine polls. Next, they divided the city into tracts, using data from the most recent census. Teams were assigned to certain blocks. Households were selected to be interviewed by teams of students.

While this was taking place, other students were assigned the task of writing a computer program that would use the data being collected to project the sample onto the city as a whole. Working with their teacher, they were able to complete the task.

Within this project, the computer was used as an analog to ongoing classroom activities. It served as an information storehouse, a data analyzer, and an arbiter of decisions. More importantly, it acted as a mechanism for solving a problem.

This example shows the potential for using computers in social studies classrooms. For the first time, teachers can use all types of original databases, from voting records to list of historical battles, within their classrooms. Besides performing higher cognitive functions, the computer can also help in teaching geographical place-names, group skills, and basic factual information.

Several library programs using social studies content already exist, such as the Minnesota Educational Computing Consortium's Oregon Trail Project. Various social studies programs featuring role-playing, simulations, and drill-and-practice sequences are now being developed also.

Besides using the computer in a traditional instructional manner, social studies teachers can also discuss the moral and ethical issues surrounding the use of computers and the information generated by them. Within this context, social studies teachers will have a large role to play. The values and attitudes needed to cope with the so-called "information explosion" will determine how we educate our society about computers and whether or not we manage this technology properly.

Many social studies classes already discuss the nature of privacy in our society. This type of discussion will become more relevant as information about us and our personal affairs is stored in computer files. Who has the right to this data? Can individuals or the government collect items about us without our knowledge? How will the computer change our lifestyles? These kinds of queries need to be examined within social studies classrooms.

## The Future

Technological breakthroughs in the computer field are occurring at a phenomenal rate. At this writing, one can purchase a hand-held programmable computer for under three hundred dollars. A mini-computer that uses a TV set as its output device is now being marketed for $199.00. In six months to a year, we may have a color micro-computer for under two hundred dollars.

Major companies are developing entire programs on computer literacy. Other publishers are making efforts to include disks and tapes for computers as part of their sales packages. Intelligent audio-disks and interactive television communications devices are already feasible technologically. The major obstacle to these items is their cost and the lack of available software for them.

If one were to project the future of computers in the social studies classroom, the key words would be "training" and "software." More social studies educators must acquire both basic computer skills and the ability to author lessons for use on the computer. We have a tool that can be an aid to our teaching—if we learn to use it.

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### Magazines


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*Computer Education.* Computer Education Group, North Staffordshire Polytechnic Computer Center, Blackheath Lane, Stafford, England.

*Computers and Education.* Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York 10523.

*Creative Computing.* P.O. Box 789-M, Morristown, New Jersey 07960.

*Computing Teacher.* Computing Center, Eastern Oregon State College, LaGrande, Oregon 97850.

*Educational Technology.* 140 Sylvan Avenue, Englewood Cliffs, New Jersey 07632.

*Journal of Computer-Based Instruction.* ADCIS, Western Washington State College, Bellingham, Washington 98225.

*Personal Computing.* 1050 Commonwealth Avenue, Boston, Massachusetts 02215.

*Popular Computing.* Box 272. Calabasas, California 91302.

*The Journal.* P.O. Box 992, Acton, Massachusetts 01720.

*SIGCUE Bulletin.* Computer Uses in Education, Association for Computing Machinery, 1133 Avenue of the Americas, New York, New York 10036.


### Organizations

The following organizations are involved in furthering the use of computers in education. All publish journals and/or newsletters.


Association for Computing Machinery. 1122 Avenue of the Americas, New York, New York 10036.

Association for the Development of Computer-Based Instructional Systems (ADCIS). Western Washington State College, Bellingham, Washington 98225.

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